

A Comprehensive CFD Tool for Aerothermal Environment Around Space Vehicles, Phase II

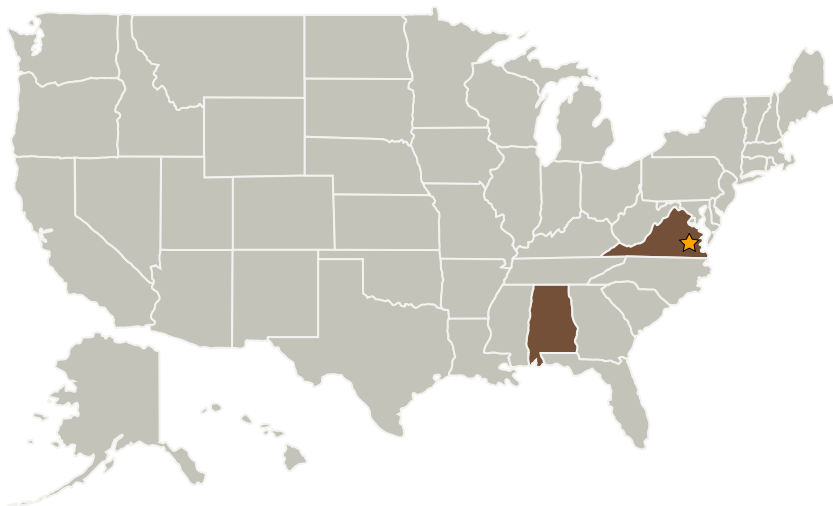
Completed Technology Project (2009 - 2012)



Project Introduction

The goal of this SBIR project is to develop an innovative, high fidelity computational tool for accurate prediction of aerothermal environment around space vehicles. This tool will be based on the Unified Flow Solver (UFS) developed at CFDRRC for hybrid simulations of rarefied, transitional and continuum flows. In this project, UFS will be enhanced to include: radiation transport, non-equilibrium chemistry with real gas effects, and weakly-ionized plasma. The unique strengths of our proposal are: (i) smart software with self-aware physics and adaptive numerics for hypersonic flows with non-equilibrium chemistry, (ii) direct Boltzmann solvers for charged and neutral particles in rarefied regimes, and (iii) a high-fidelity multi-scale radiation transport model that can handle orders of magnitude variation of optical thickness. During Phase 1, we evaluated the relevant physical models and numerical algorithms, and started initial implementation and demonstration of the new capabilities. In Phase 2, these capabilities will be fully developed, validated and demonstrated for selected benchmark problems of interest to NASA. The proposed tool will significantly upgrade the modeling fidelity of high-speed weakly-ionized flows of molecular gases, and enable computational investigation of innovative hypersonic plasma technologies.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission
Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation
Research/Small Business Tech
Transfer

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Organizations Performing Work	Role	Type	Location
★ Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
CFD Research Corporation	Supporting Organization	Industry	Huntsville, Alabama

Primary U.S. Work Locations

Alabama	Virginia
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Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
 - └ TX15.1 Aerosciences
 - └ TX15.1.2 Aerothermodynamics